

Appl. No.: 10/039,290  
Amdt. Dated: 06/06/2005  
Off. Act. Dated: 03/08/2005

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (original): An apparatus for providing non-contact thermal measurements at high spatial and thermal resolutions, comprising:

an illumination source;

means for generating a signal in response to registration of the magnitude of light received from said illumination source that is reflected from the surface of an object; and

means for generating a bandwidth-limited AC-component of the signal from said illumination detector while said object is subjected to modulated thermal excitation.

2. (original): An apparatus for providing non-contact thermal measurements at high spatial and thermal resolutions, comprising:

an illumination source;

an array of individual illumination detectors;

said illumination detectors configured to generate signals in response to registration of the magnitude of light received from said illumination source that is reflected from the surface of an object; and

a signal processor;

said signal processor configured to filter one or more direct current components from said signal while said object is subjected to modulated thermal excitation to discern a small thermoreflectance signal from noise.

Appl. No.: 10/039,290  
Amtd. Dated: 06/06/2005  
Off. Act. Dated: 03/08/2005

3. (original): An apparatus as recited in claim 1, wherein said means for generating a signal in response to registration of the magnitude of light received from said illumination source that is reflected from the surface of an object comprises:  
an array of individual illumination detectors.

4. (original): An apparatus as recited in claim 3, wherein:  
said array of illumination detectors is adapted to generate information on the intensity of light received by each of said individual illumination detectors in the array.

5. (original): An apparatus as recited in claim 1 or 2, further comprising:  
a display;  
said display adapted for displaying a bandwidth-limited AC-component of the signal.

6. (original): An apparatus as recited in claim 1 or 2, further comprising:  
means for receiving a bandwidth-limited AC-component of the signal and computing a thermal measurement based on a change in registered surface reflectance.

7. (original): An apparatus as recited in claim 6:  
wherein said object has a known thermoreflectance constant; and  
wherein said change in registered surface reflectance is in response to a change in the thermoreflectance coefficient of the surface material of said object resulting from a temperature change associated with said thermal excitation.

8. (original): An apparatus as recited in claim 1 or 2, further comprising:  
means for generating a superresolution image from a combination of thermal images having a lower spatial resolution.

Appl. No.: 10/039,290  
Amdt. Dated: 06/06/2005  
Off. Act. Dated: 03/08/2005

9. (original): An apparatus as recited in claim 8, wherein said means for generating a superresolution image comprises:

a computer; and

programming associated with said computer for,

receiving a plurality of thermal images having a first image resolution, and

combining said thermal images having said first resolution by interpolating pixel values into a thermal image having a higher second resolution.

10. (original): An apparatus as recited in claim 1 or 2, wherein said illumination source comprises a laser light source.

11. (original): An apparatus as recited in claim 10, wherein said laser light source operates at wavelength ranging from approximately 500 nm to approximately 800 nm.

12. (original): An apparatus as recited in claim 10, wherein said laser light source has a wavelength of approximately 655 nm.

13. (original): An apparatus as recited in claim 10, wherein said laser light source has an output power ranging from approximately 1 mW to approximately 100 mW.

14. (original): An apparatus as recited in claim 10, wherein said laser light source has an output power of approximately 5 mW.

15. (original): An apparatus as recited in claim 1 or 2, further comprising:  
an x-y translation stage;

Appl. No.: 10/039,290  
Amdt. Dated: 06/06/2005  
Off. Act. Dated: 03/08/2005

said translation stage configured to provide motion to said illumination source and said illumination detector in relation to the surface of said object;

wherein a thermal image may be constructed from data collected during scanning of the surface of said object.

**16. (original): An apparatus as recited in claim 15:**  
wherein said x-y translation stage comprises a piezoelectric translation stage;  
wherein said translation stage provides movement resolution that is approximately equal to or higher than the desired spatial resolution at which the object is being measured.

**17. (original): An apparatus as recited in claim 1 or 2:**  
wherein said illumination source is configured to generate a beam spot size that approximates, or is less than, the desired spatial resolution of thermal measurement.

**18. (original): An apparatus as recited in claim 17, further comprising:**  
an inverse-filter which is applied to remove image blurring caused by an excessively large illumination spot size.

**19. (original): An apparatus as recited in claim 1 or 2, wherein said illumination detector comprises a photodiode.**

**20. (original): An apparatus as recited in claim 2 or 3, wherein said array of illumination detectors comprises an array of photodetectors ranging in size from approximately 16 x 16 array to approximately 64 x 64.**

Appl. No.: 10/039,290  
Arndt, Dated: 06/06/2005  
Off. Act. Dated: 03/08/2005

21. (original): An apparatus as recited in claim 2 or 3, wherein said array of illumination detector comprises an array of photodetectors ranging in size from approximately 2 x 2 to approximately 256 x 256.

22. (original): An apparatus as recited in claim 1 or 2, wherein the frequency range of said modulated thermal excitation to which said object is subjected ranges from approximately 0.1 Hz to approximately 100 kHz.

23. (original): An apparatus as recited in claim 1, wherein said means for generating a bandwidth-limited AC-component of the signal from said illumination detector while said object is subjected to modulated thermal excitation comprises:

a signal processor;  
said signal processor configured to filter one or more direct current components from said signal to discern a small thermoreflectance signal from noise.

24. (original): An apparatus as recited in claim 2 or 23, wherein said signal processor is selected from the group of narrow band filters consisting essentially of a lock-in amplifier, differential boxcar averaging circuit, and FFT analyzer.

25. (original): An apparatus as recited in claim 2 or 23, wherein said signal processor is configured to filter out components of the signal other than a single harmonic of the registered illumination level.

26. (original): A method as recited in claim 25:  
wherein said single harmonic that is at, or associated with, the frequency of modulation to which said object is subjected.

Appl. No.: 10/039,290  
Amtd. Dated: 06/06/2005  
Off. Act. Dated: 03/08/2005

27. (original): An apparatus as recited in claim 2 or 23, wherein said signal processor is configured to pass a band of frequencies that is less than approximately 10 Hz.

28. (original): An apparatus as recited in claim 2 or 23, wherein signal processor has a passband having a maximum width of approximately 1 Hz.

29. (original): An apparatus as recited in claim 2 or 23, wherein said signal processor is configured to pass a band of frequencies that is limited to approximately 0.1 Hz.

30. (original): An apparatus as recited in claim 1 or 2, further comprising:  
an imaging device adapted to receive a portion of the reflected illumination for aligning position of the illumination source in relation to the object.

31. (original): An apparatus as recited in claim 30, further comprising:  
a splitter configured to direct portions of said reflected illumination to said imaging device.

#### Claims 32-39 (canceled)

40. (original): A method for providing high resolution thermal imaging of an object being subjected to thermal modulation, comprising:  
illuminating an area on the surface of an object for which thermal information is desired;  
detecting illumination reflected from said area; and  
generating an AC-coupled bandwidth-limited signal in response to detected illumination.

Appl. No.: 10/039,290  
Amtd. Dated: 06/06/2005  
Off. Act. Dated: 03/08/2005

41. (original): A method as recited in claim 40:  
wherein said AC-coupled signal has a bandwidth with a center at, or associated  
with, the frequency of modulation to which said object is subjected.

42. (original): A method as recited in claim 40, further comprising:  
resolving the AC-coupled signal into an image.

43. (original): A method for providing high resolution thermal imaging of an  
object being subjected to thermal modulation, comprising:  
illuminating an area on the surface of an object for which thermal information is  
desired;  
detecting illumination reflected from said area;  
generating an AC-coupled bandwidth-limited signal in response to detected  
illumination; and  
resolving the AC-coupled signal into an image.

44. (original): A method as recited in claim 43:  
wherein said AC-coupled signal has a bandwidth with a center at, or associated  
with, the frequency of modulation to which said object is subjected.

Claims 45-48 (canceled)